Bundguard 5

Installation and Operation Manual

Andel Limited
Unit 1 Dodworth Business Park South,
Upper Cliffe Road,
Dodworth,
Barnsley
S75 3SP

Tel +44 (0) 1484 845000
Fax +44 (0) 1484 845222

www.andel.co.uk

Contents

Thank you for selecting the Bundguard 5. This manual provides safety, installation, and operation information. Please, read before installing or operating the unit and retain for future reference.

1. Important safety instructions

It is important that you read all the instructions before installing or using this equipment; paying particular attention to the statements following the symbols detailed below.

Danger:
Risk of electric shock, the control panel contains high voltages and installation work should be carried out with power isolated.

Risk of electric shock, the installer is required to access the unit with power applied in order to set up the system the installer should therefore be correctly trained before setting up the system.

If the equipment is not used in the manner specified by the manufacturer, the protection provided by the equipment may be impaired.

Under no circumstances should additional holes be made in the enclosure.

This equipment is for indoor and outdoor use.

Caution: the mains terminal cover on the PCB must be replaced should it be removed prior to use.

Warning: this equipment must be earthed.

The BundGuard control panel must be provided with an Earth (Ground) to ensure correct and safe operation. If the panel is not correctly earthed (grounded),

Andel Limited cannot guarantee correct operation of the system.

Warning: connection of peripherals should only be carried out once the mains supply has been isolated by breaking the RCD contactor.

Warning: disconnect the mains supply before undertaking any maintenance work within the equipment. Any unused cable entry point must be blanked off to prevent access using suitably rated IP65/66 blanking plug.

2.Introduction

Thank you for selecting the BundGuard Issue 5 bund dewatering system. This manual provides safety, installation and operation information, please, read before installing or operating the unit and retain for future reference.

The Andel BundGuard Issue 5 is a tried and tested fully automatic bund dewatering system, which discriminates between oil and water. It continuously monitors the levels of rainwater and oil collecting in the bund. When a pre-set water level is reached the pump is activated and the water removed from the bund.

The system consists of a control panel, combined sensor and pump, hose and fixing key. The pump/sensor unit is usually mounted in a sump within the bund to ensure the water level within the bund is kept below the top of the sump. It is connected to the control panel, which controls the pump(s) and also contains the warning indicators and alarm outputs. Warning indicators are provided for system status, pump failure or malfunction and when oil leaks or spillages reach a maximum level. A typical installation for a single pump configuration is shown in Figure 1.

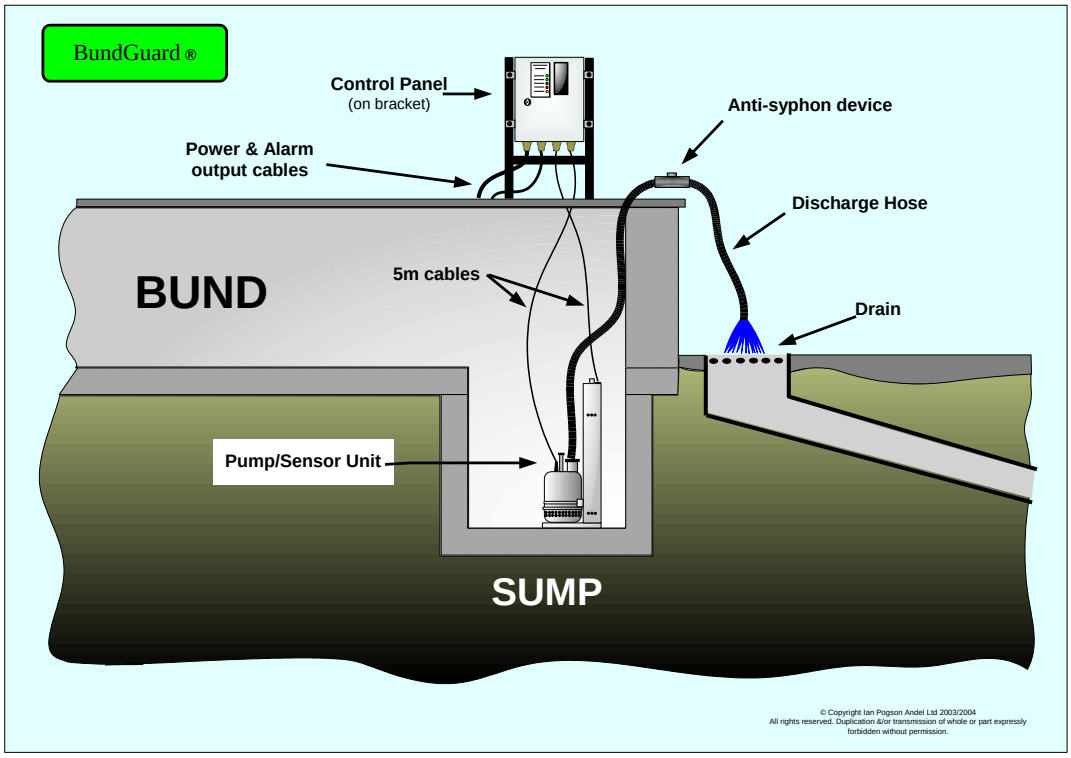

Figure 1 Typical BundGuard Installation

2.1 Available Models

The BundGuard Issue 5 is available in three variations, these are entitled:
Option 1
Option 1 + GSM

The variation of the BundGuard Issue 5 includes all core-functionality expected from a bund de-watering system. The BundGuard Issue 5 option 1 variation includes more sophisticated alarms, detection circuitry, and data interfaces on top of the features of the variation. Option 1 + GSM adds the ability to forward textual alarms via SMS message over a GSM network.

The specific features built into each variation is detailed in the table below:

Each feature is described in more detail throughout the remainder of this manual.

Feature	Option 1	Option 1 GSM
High oil		
High water		
Mains failure		
System fault		
Pump disable		
Historical data		
Alarm delay customisation		
Technical support code		
Connector disconnection alarm		
LCD menu system		
Textual alarms		
Capability for 2 pumps		
Filter back-pressure monitoring support		
Outlet water meter support		
Pump current monitoring		
Auto changeover		
Over-current disable		
Battery backup		
Mains Alert(Common alarm mains switch output)		
MODBUS RTU interface		
SMS alarm forwarding		

2.2 Alarms

The BundGuard Issue 5 has numerous alarms that can be triggered by specific events the table below give details of all the alarms.

Alarm – (LCD Text)	Indicator	Relay	Cause of Alarm
Mains Failed (no LCD text)	none	Mains Failure	The mains supply input have failed.
ER0 Probe Error	System Fault	System Fault	The combination of the sensor input states indicates an unknown bund state
High Water	High Water	High Water	Bund water level exceeded
High Oil	High Oil	High Oil	Bund oil level exceeded
ER 1 HIGH SHORT	System Fault	System Fault	The sensor's high water probe is short circuited to the common probe when pump start probe out of water.
ER 2 START SHORT	System Fault	System Fault	The sensor's pump start probe is short circuited to the common probe when sensors stop probe out of water
ER 3 STOP OPEN	System Fault	System Fault	The sensor's pump stop probe is open circuit when start probe is in water.
ER 4 START OPEN	System Fault	System Fault	The sensor's pump start probe is open circuit when high water probe is in water.
Pump1 > limit	System Fault	System Fault	The current drawn by Pump 1 has exceeded its pre-set limit
Pump2 > limit	System Fault	System Fault	The current drawn by Pump 2 has exceeded its pre-set limit
Connector N/C	System Fault	System Fault	One or more control panel connectors is not connected correctly
Pump1 disable	Pump 1 Disable	Pump 1 Disable	The drive circuitry for Pump 1 has failed in a pumping state and has been disabled
Pump2 disable	Pump 2 Disable	Pump 2 Disable	The drive circuitry for Pump 2 has failed in a pumping state and has been disabled
Pressure1 > lim	System Fault	System Fault	The outlet filter (designated filter 1) pressure has exceeded a pre-set threshold
Pressure2 > lim	System Fault	System Fault	The outlet filter (designated filter 1) pressure has exceeded a pre-set threshold
Batt engaged	System Fault	System Fault	The mains supply has dropped below a usable level or has been removed completely.
Pump1 >Cur Disab	none	None	Pump 1 has exceeded a pre-set threshold 3 times and is now disabled from use.
Pump2 >Cur Disab	none	none	Pump 1 has exceeded a pre-set threshold 3 times and is now disabled from use.

2.3 System Components

2.3.1 Control Panel

The control panel is a stainless steel IP66 enclosure for mounting locally to the sensor unit and pump(s), outside the bund. The control circuitry uses the sensor inputs to determine whether a pump should be ON or OFF and generate any necessary alarms. This behaviour of the pump(s) and alarm can be customised through the menu system shown on the internal LCD.

The control panel provides zero-volt free contact relays rated at 220Vdc @ 0.1A for the following alarms:
Mains failure
High Water
High Oil
System Fault
Pump 1 disable
Pump 2 disable

The control panel also presents LED indicators to signify the following alarms:

Front Panel LED	Colour
Power	Green
System Fault	Red
Pump 1 Active	Green
Pump 2 Active	Green
High Oil Alarm	Red
High Water Alarm	Red
Pump 1 Disabled	Yellow
Pump 1 Disabled	Yellow

The control circuitry incorporates a pair of independent electronic fail-safe(dead stop) circuits “pump disable” the feature is incorporated to provide a fail-safe for the main switching contacts to the pump. This feature will isolate the pump in the event of a system malfunction. A pump disable alarm is indicated by the respective relay and front panel LED activating. The pump disable always momentarily activates after an ON to OFF transition of the pump, this is normal, and should be ignored. A de-bouncing delay of 1 second on any system monitoring this output is recommended.

In addition to the LED indicators listed above the unit also has an LCD screen which gives further alarm details and system information. When no alarms are active the number of pump operation is displayed.

2.3.2 Bundguard Issue 3A Sensor / Pumps Unit

The pump and sensor unit are a combined submersible IP68 unit manufactured entirely from stainless steel. If a second pump is fitted this will be mounted separate to the sensor and pump combination.
Individual multi-core 10m cables are fitted for both:
-Pump power (230ac or 110V ac)
-Sensor probes

Figure 3 shows the operational dimensions of the BundGuard Issue 3A combined sensor /pump installed into a 600mm x 600mm x 600mm sump (which is the minimum recommended size for the sump)

A 5m length of reinforced 25mm rubber discharge hose is provided with the system along with necessary fixings.

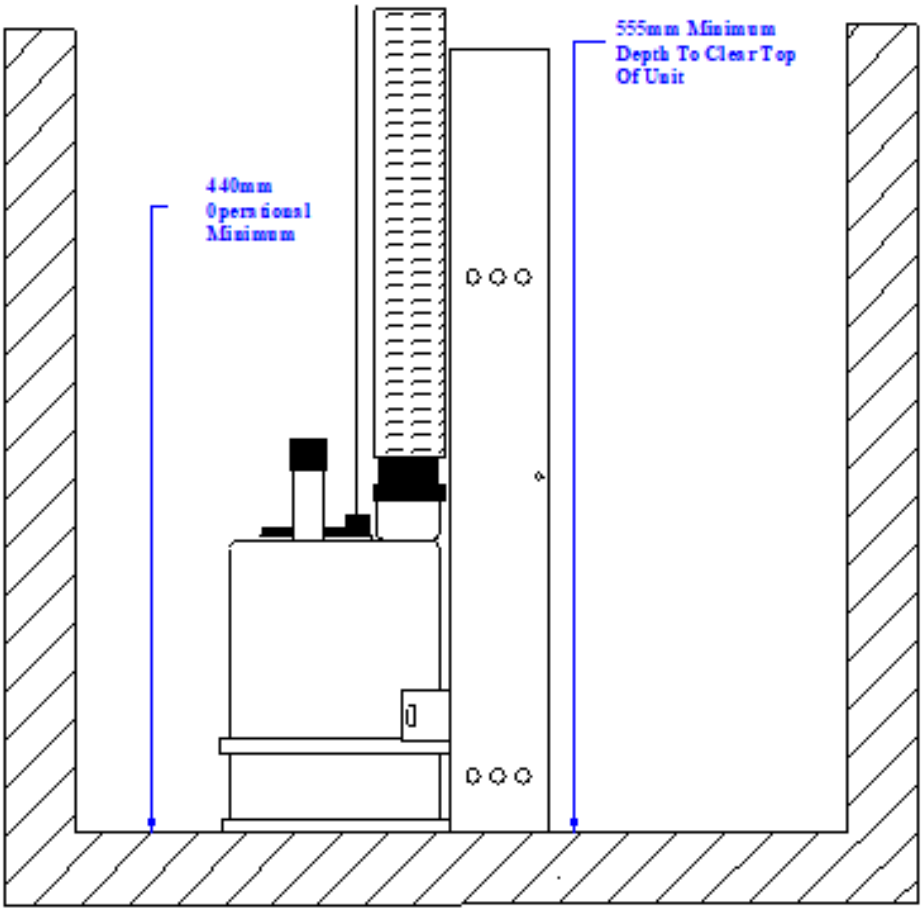

Figure 3 BG Issue 3A Sensor Details.

2.3.2.1 Sensor Unit

The sensor unit internally has 4 probes and one float switch, Sensor probes are pre-cut at manufacture to optimum dimensions to minimise wear on the pump and ensure correct operation. The probes can be adjusted a further ±25mm during installation to conform to particular requirements depending upon the bund and sump geometry. Figure 4 show the sensor probe configuration and their function.

! The Pump stop and common probes must not be adjusted.

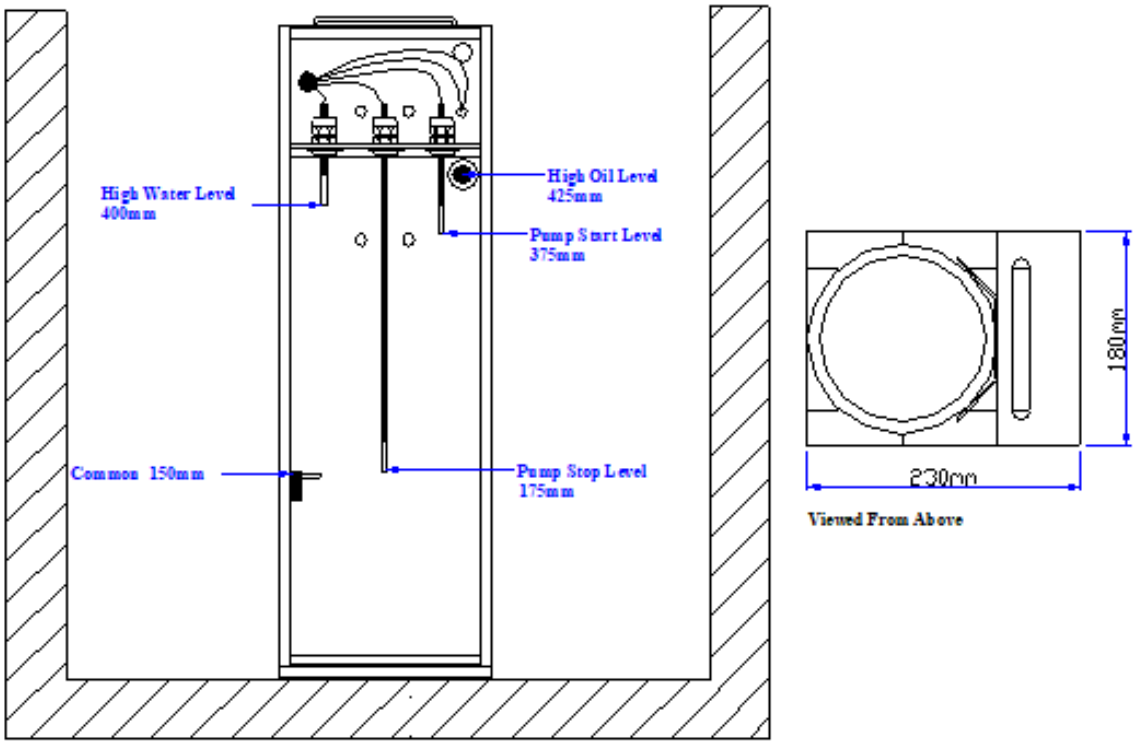

Figure 4 BundGuard Issue 3A Sensor Configuration

2.3.2.2 Ebara Best One Submersible Pump

The attached Ebara Best One submersible pump has a pumping capacity of 140Litres/minute with a 2-3m head. The pump comes fitted with barbed 1 inch hose tail for connection to the supplied hose (5m with unit)

2.3.2.3 Fixing Kit

The system is supplied with a fixing kit which includes all necessary fixing and glands for installation. An anti-syphon device is supplied in the fixing kit for fitting in-line into the discharge hose.

3. Installation

3.1 Control Panel Mounting

The control panel houses all electrical and electronic circuitry and connection points and must be mounted externally to the bund, located such that the panel will not be submerged in normal operation. The control panel is typically mounted on the bund wall or mounting frame attached to the bund wall, using either the M6 wall anchors or M6 bolts provided within the fixing kit. There are 4 x 20mm mounting holes in the base of the control panel for entry of the mains power, telemetry, pump power and sensor cables. The fixing kit provides CW20S gland for SWA mains power and telemetry cables and M20 plastic glands for the pump and sensor cables.

3.2 Sensor and Pump Mounting

The pump(s) and sensor unit are placed at the lowest point of the bund. Most bunds have a section that has a floor lower than that of the majority of the bund floor; this is called a 'sump'. If a sump is present, that is where the BundGuard pump and sensor unit should be located.

The pump and sensor unit are included with 10m long cables to connect to the control panel. Consult the connection diagrams in this section prior to applying power to the BundGuard control panel.
The anti-syphon device is supplied in the fixing kit should be positioned at the highest point, where the discharge hose passes over the bund wall for example. The arrows moulded into the body of the anti-syphon device should point in the direction of the outflow (away from the pump).

! The anti-syphon device must not be located inside the bund.

3.3 Panel & Sensor Connections

The BundGuard is supplied in one of two connectivity configurations. Option 1 as detailed below:

! **Installation should only be carried out by suitable trained personnel**.

Option 1 Terminal Configuration		
Term. N°	Name	Description
Incoming Power connection		
1	Input Neutral	RCD Mains Neutral
2	Input Live	RCD Mains Live
3	Input Earth	Mains Earth
Pump Power connection		
4	Pump 1 Neutral	Un-switched neutral for pump 1
5	Pump 1 Live	Switched live for pump 1
6	Pump 1 Earth	Un-switch earth for pump 1
7	Pump 2 Neutral	Un-switched neutral for pump 2
8	Pump 2 Live	Switched live for pump 2
9	Pump 2 Earth	Un-switch earth for pump 2
Common Alarm 230Vac Output Connections		
10	Common Neutral	Un-switched neutral for beacon or sounder
11	Common LIVE	Switched live for beacon or sounder
12	Common Earth	Un-switched earth for beacon or sounder
Telemetry (relay) connections		
13	Pump2 Disable Relay	Pump 2 disable NO relay contact
14	Pump1 Disable Relay	Pump 1 disable NO relay contact
15	Mains Fail Relay	Mains failure NC relay contact
16	High Oil Relay	High oil NO relay contact
17	System Fault Relay	System fault NO relay contact
18	High Water Relay	High water NO relay contact
19	Relay Common	Common connection to all alarm relays
Sensor Connection		
20	Oil +VE	Positive switch connection to oil float switch
21	Oil -VE	Negative switch connection to oil float switch
22	High Water Probe (red)	High water probe from sensor unit
23	Start Probe (Yellow)	Start probe from sensor unit
24	Stop Probe (blue)	Stop probe from sensor unit
25	Common probe (Black)	Common probe from sensor unit
Auxiliary Equipment connections (Filter /flow meters)		
26	GND	Control panel signal ground
27	+12V	Control panel signal +12V
28	Pressure 1 input	Pressure 1 sensor 4-20mA or switched input
29	Pressure 2 input	Pressure 2 sensor 4-20mA or switched input
30	Flow input	Flow rate sensor 4-20mA input

4. System Setup

After physical installation, the systems settings may require adjusting this is achieved through the installer interface, the table below give details of the menu structure of the interface and further details of the operation and settings of each menu items follow.

Menu system	
Menu Items	**Description**
Menu 0/8 – Date and time	Sets date and time
Menu 1/8 – Pump & alarms	Menu for setting pump and alarms
Num. Of Pumps	Sets number of pumps 1 or 2
Set threshold	Set pump current threshold 0-5000mA
Autochange Over	Sets auto changeover (on / off)
HWA Delay	High water alarm delay 0 -60 minutes
View Current	View pump current (mA)
Overcurrent trip	Sets overcurrent protection on or off
Pump delay	Sets pump on delay 3-30 seconds
Main fail	Set mains fail alarm on or off
Menu 2/8 - Modbus	
En/Disable	Enable / Disable Modbus communications
RS485	No user options available
Modbus I/D	Set Modbus address 01 - 247
Modbus baud rate	Set Modbus baud rate 300-57600
Listen only	Sets listen mode on or off
Menu 3/8 - Filter	
Pressure measure	
Filter type	Set type of filter (switched, measurement)
Set thresh 1	Set threshold for filter 1
Set thresh 2	Set threshold for filter 2
Set Num. Of filters	Set number of filters 1 or 2
Pressure @20mA	Set Pressure at 20mA
Pressure @4mA	Set pressure at 4mA
View Pressure	View current pressure reading
Menu 4/8 – Flow meter	
Meter Enable	Set meter to on or off
Current flow	View current flow reading
Flow @ 20mA	Set flow at 20mA
Set flow at 4mA	Set flow at 4mA
Menu 5/8 -connector	Set connector disconnect on or off
Menu 6/8 - GSM	
En/disable GSM	Enable disable GSM
Set forwarding Number	Set number to send message to
View details	View GSM detail (see page xx)
SIM status	Status of SIM card
Network Status	Network status
Operator name	Name of mobile operator
Menu 6/7 - History	View event history 1 to144(max) events
Menu 8/8 - Info	
Serial Number	Panel serial number
Debug code	Debug code (for fault finding)

4.1 Installer Menu Operation

The installer system setup menu is excessed via keypad situated top right of the control PCB. The operation of each of the 6 keys is as detailed in the table below.

Key	Description
Menu	Pressing this key enter /exits the menu system
UP	Press UP Key scrolls up available option
Down	Press UP Key scrolls up available option
Left	Move left along parameter being edited
Right	Move Right along parameter being edited
Accept	Selects sub menu and or save changes to made

4.1.1 Setting Date/Time

Within the Date and Time menu page, the operator can specify the current Date and Time that is used for history log recording and time-based operations. The date and time are set prior to shipment but should be check upon installation.

4.1.2 Setting Number of Pumps

Used to set the number of pumps connected to the unit to either 1 or 2 pumps (Option 1 and above).

4.1.3 Set Current Trip Threshold

Used to set the pump trip current threshold the default setting is 2800mA and should only be change after checking current rating of any pump attached. (Option 1 and above). The same threshold is set for both pumps 1 and 2.

4.1.4 Setting Auto-Changeover

Used for enabling or disabling the Auto-changeover function, when enabled, cycles the pumping duty between the two connected pumps. During a high-water alarm state, the standby pump would also be switched on.

Cycling the pumping duty for normal pumping operations reduces the number of pumping cycles for each pump and decreases wear on the pump drive circuitry and each pump (Option 1 and above).

4.1.5 High Water Delay

The high-water delay is a time delay specified to delay the time between recognising a water level above the high water probe, and reacting by executing the high water routine (dependant on BundGuard model). Enabling this feature allows the site-operator to subdue intermittent high-water alarms upon times of heavy rainfall or large influx of water.

4.1.6 View Current (pump current reading)

Allow installer to view current drawn by active pump(s) (Option 1 and above).

4.1.7 Setting Overcurrent Trip

Overcurrent protections enable is a toggle control for protection of the pump, should it draw current higher than the threshold set. The pump drawing the abnormal amount of current will automatically be shut off and started again after a 5 second delay. If this cycle executes 3 times consecutively, the pump will be disabled until the next time the BundGuard is power-cycled. (Option 1 and above).

4.1.8 Setting Pump Switching Delay

This feature enables the installer to set a length of time between recognising a water level above the start probe and reacting by enabling the pump. This time is set in a range of 3 to 30 seconds.
Enabling this delay can lower the number of pumping cycles the pump and drive circuitry must endure. Decreasing failure rate of pump and switching relay.

4.1.9 MODBUS

A MODBUS connection is available on BundGuard models.
MODBUS is available via RS232 or RS485.
The connectivity options available are:
-MODBUS enable (default: OFF)
-Serial protocol (default: RS485)
-MODBUS ID (default: 1)
-Listen mode (default: OFF)
-Baud rate (default: 19200)
The MODBUS ID is also configurable to a value within the range allowable in the MODBUS specification. When addressing devices on the MODBUS bus, a unique device identifier number is required for each device. This can only be set via the control panel menu system.

Listen mode is a non-responsive state that the MODBUS module can be placed in to. It permits the device to only acknowledge and action any requests to write data. In listen mode, the MODBUS device will not respond to successful or erroneous requests. It will however maintain the communication logs for all requests received (Packets received, CRC errors etc). Listen only can be toggled ON or OFF in the control panel menu.
Baud rate also must be set in the control panel menu. All values specified in the MODBUS serial specification are available. These values are:
-300 baud
-600 baud
-1200 baud
-2400 baud
-4800 baud
-9600 baud
-14400 baud
-19200 baud
-28800 baud
-38400 baud
-56000 baud
-57600 baud

4.1.10 Floating Paint Values

The BundGuard issue 5 stores some register values in a floating point format. This is to allow for wide ranges of decimal values to be stored. Floating point values are stored in a little-endian format across two 16-bit MODBUS register locations. The data structure for how floating-point values are formatted within these two register values is shown below.

31	30	23	22	16	15	0
Sign	Exponent		Fraction			
MODBUS data [1]					MODBUS data [0]	
15	14	7	6	0	15	0

This table shows the data structure for floating point MODBUS register values.

4.1.10.1 Registers

The BundGuard issue 5 supports the MODBUS RTU protocol via RS232 or RS485. The serial protocol is configured in the menu system. The BundGuard issue 5 supports the full MODBUS RTU specification, including extended individual and stream access to device identification objects. Full details of these functions are detailed in the MODBUS application specification.
Any values that span more than one register address, are always little-endian format.
Available data via the MODBUS interface is provided in the registers detailed below:

4.1.10.2 Discrete inputs

Discrete inputs are read-only Boolean bits that indicate the ON/OFF state of a certain feature or alarm. These can be accessed through use of correctly formatted MODBUS protocol read-coil functions detailed in the MODBUS specification.

Reg	Name	Description
0	Unknown Probe error	Indicates an unknown probe error fault when set
1	High water	Indicates a high water alarm when set
2	High Oil	Indicates a high oil alarm when set
3	High Short	Indicates a high short alarm when set
4	Start short	Indicates a start short alarm when set
5	Stop open	Indicates a stop open alarm when set
6	Start open	Indicates a start open alarm when set
7	P1 current	Indicates Pump 1 is reading a current value above the threshold
8	P2 current	Indicates Pump 2 is reading a current value above the threshold
9	Connector	Indicates a disconnected connector when set
10	P1 disable	Indicates a pump disable alarm for pump 1 when set
11	P2 disable	Indicates a pump disable alarm for pump 2 when set
12	Pressure 1	Indicates an over-pressure alarm for sensor 1 when set
13	Pressure 2	Indicates an over-pressure alarm for sensor 2 when set
14	Battery backup	Indicates a mains failure and operation from battery power when set
15	P1 current disable	Indicates pump 1 has been disabled due to continued over-current alarms when set
16	P2 current disable	Indicates pump 2 has been disabled due to continued over-current alarms when set
17	GSM connected	Indicates the GSM module has connected to a network when set
18	Pump Stop	Indicates the water level is below the start probe and all pumps are disengaged
19	Pump Start	Indicates the water level is above the start probe and respective pumps are engaged
20	Pump Mid	Indicates the water level is between the start and stop probe and the pumps are engaged
21	Over current 1	Pump 1 is temporarily halted to attempt to recover from an over-current event
22	Over current 2	Pump 2 is temporarily halted to attempt to recover from an over-current event
23	GSM initialised	The GSM module has initialised and has started discovery of a network
24	2nd pump	The second pump has been enabled when set
25	GSM	The GSM module is enabled when set
26	Flow monitoring	Flow monitoring enabled when set
27	Battery backup	Battery backup enabled when set
28	Current monitoring	Current monitoring enabled when set
29	Pressure monitoring	Pressure monitoring enabled when set
30	Filter sensor type	Sensor type selected is a switch-type when set and transducer-type when reset
31	MODBUS	MODBUS enabled when set (included for completeness)
32	Connector disconnect	Connector disconnect alarm enabled when set
33	Auto changeover	Auto changeover enabled when set
34	Mains alert	Mains alert relay enabled when set
35	GSM configured	GSM has a valid forwarding number assigned when set
36	MODBUS protocol	MODBUS is communicated via RS485 when set and RS232 when reset

37	Over current protection	Over-current pump disable enabled when set
38	Second filter enabled	Two filters are configures for pressure measurement when set
>38	Reserved	Unused in application – Do not use

4.1.10.3 Input Registers

The BundGuard allows read-only access to a variety of register values on the BundGuard.
These are listed below:

Reg#	Name	Description	Format
0	Filter 1 pressure [0]	The instantaneous pressure of pressure sensor 1	Bit 0-15 of floating point
1	Filter 1 pressure [1]		Bit 16-31 of floating point
2	Filter 2 pressure [0]	The instantaneous pressure of pressure sensor 2	Bit 0-15 of floating point
3	Filter 2 pressure [1]		Bit 16-31 of floating point
4	Pump 1 current	The instantaneous current drawn by pump 1	Unsigned integer
5	Pump 2 current	The instantaneous current drawn by pump 2	Unsigned integer
6	Flow total [0]	The total volume of liquid pumped from the bund in Litres	Bit 0-15 of floating point
7	Flow total [1]		Bit 16-31 of floating point
8	Cycle Count	The total number of times the pump(s) have switched ON.	Unsigned integer
9	Flow rate [0]	The instantaneous flow rate measured by the outlet flow meter	Bit 0-15 of floating point
10	Flow rate [1]		Bit 16-31 of floating point

Values provided in a floating point format conform to 32-bit floating point bit structuring. This formatting is detailed in the floating point section.

4.1.10.4 Holding registers

Read and write access is provided for the following values on the BundGuard:

Reg#	Name	Description	Format
0	Filter 1 pressure threshold [0]	The pressure that causes an over-pressure 1 alarm	Byte 0 of floating point
1	Filter 1 pressure threshold [1]		Byte 1 of floating point
2	Filter 2 pressure threshold [0]	The pressure that causes an over-pressure 2 alarm	Bit 0-15 of floating point
3	Filter 2 pressure threshold [1]		Bit 16-31 of floating point
4	Pump 1 current threshold	The current that causes an over-current alarm	Unsigned integer

4.1.10.5 Custom function codes

The BundGuard allows access to the non-volatile memory where event logs are stored. This access is provided through the use of a manufacturer-defined function code that is permissible within the MODBUS.

Request formatting must adhere to the MODBUS specification, whereby the familiar address, function code, data packet, and cyclic redundancy check fields are compulsory.

4.1.10.6 getNumEvents

getNumEvents returns the quantity of log entries available to requested of the BundGuard. This value can be up to and including 144.
A data field is not required in the request for the event count number but is provided in the response.

4.1.10.7 Request

Function code: 65 (decimal), 0x41 (hex)
This function will not execute or respond when received addressed to the broadcast (address == 0x00) ID.

Field	Name	Total bytes	Data type
1	Address ID	1	Unsigned integer
2	Function code (0d65/0x41)	1	Unsigned integer
3	CRC	2	Checksum

4.1.10.8 Response

If the request was correct, the response will be formatted as shown below:

Field	Name	Total bytes	Data type
1	Address ID	1	Unsigned integer
2	Function code (0d65/0x41)	1	Unsigned integer
3	Number of historic events	1	Unsigned integer
4	CRC	2	Checksum

4.1.10.9 Error

Only one error can be produced by operation of this function. If the processor hardware encounters an error when retrieving the event count; an error code will be responded back to the master.
The error code will only ever be “Server device failure” – 0x04.

4.1.10.10 getEvent

The getEvent function allows the querying MODBUS master to request an event structure for an event number. Event numbers increment from 0 to 143. Event 0 always referring to the most recent event, and event 143 referring to the least recent. This data is from the same source of that shown in the “History” menu tab of the BundGuard menu system.

4.1.10.11 Request

Function code: 0d66 (decimal), 0x42 (hex)
This function will not execute or respond when received addressed to the broadcast (address == 0x00) ID.

Field	Name	Total bytes	Data type
1	Address ID	1	Unsigned integer
2	Function code (0d66/0x42)	1	Unsigned integer
3	Event number	1	Unsigned integer
4	CRC	2	Checksum

4.1.10.12 Response

If the request was correct, the response will be formatted as shown below:

Field	Name	Total bytes	Data type
1	Address ID	1	Unsigned integer
2	Function code (0d67/0x41)	1	Unsigned integer
3	Event number	1	Unsigned integer
4	Event.time	4	Unsigned 32bit integer
5	Event.ID	1	Enumeration
6	CRC	2	Checksum

Fields 4 and 5 provide the data for the requested event. Field 4 is a 32-bit unsigned integer. This value is a unix time-stamp (POSIX time) of when the event occurred.

[A unix time stamp is a count of the number of seconds since 1970-01-01]

Field 5 provides an enumeration of the event that occurred. The enumeration table is shown:

Event enum	Description	Text
0	The sensor unit probes entered an unknown error state	ER 0 Probe Error
1	The sensor unit detected a high water state	High water
2	The sensor unit detected a high oil state	High oil
3	The sensor unit detected a high water short state	ER 1 HIGH SHORT
4	The sensor unit detected a start water short state	ER 2 START SHORT
5	The sensor unit detected a stop water open state	ER 3 STOP OPEN
6	The sensor unit detected a start water open state	ER 4 START OPEN
7	Pump 1 was measured drawing a current above the threshold	Pump1 > limit
8	Pump 2 was measured drawing a current above the threshold	Pump2 > limit
9	The plug and play connector was disconnected	Connector N/C
10	Pump 1 disable circuit was engaged	Pump1 disable
11	Pump 2 disable circuit was engaged	Pump2 disable
12	Filter pressure 1 was measured above the threshold	Pressure1 > lim
13	Filter pressure 2 was measured above the threshold	Pressure2 > lim
14	The BundGuard engaged battery power	Batt engaged
15	Pump 1 was disabled due to repeated over-current alarms	Pump1 >Cur Disab
16	Pump 2 was disabled due to repeated over-current alarms	Pump2 >Cur Disab
17	The GSM module has connected to a network	GSM connecting
18	The BundGuard disengaged battery power	Batt disengaged
19	The BundGuard lost mains (and battery, if installed) power	Unit powered OFF
20	The BundGuard was powered up by mains or battery power	Unit powered ON
21	The on-board processor was reset (processor resets itself automatically on power up)	Processor reset

4.1.10.13 Error

One of two errors after receiving a valid request for this function can be sent. An “illegal data address” error (0x03), or “Server device failure” error (0x04).

An illegal data address error is sent when the requested event number is greater than the number of events available. A server device failure error is sent when the processor fails to read the requested event from the non-volatile memory.

These errors are sent in the format shown below.

4.1.10.14 Error Format

All errors detailed for these manufacturer specific function codes are sent in the MODBUS format as shown below.

Field	Name	Total bytes	Data type
1	Address ID	1	Unsigned integer
2	Error function (function code || 0x80)	1	Unsigned integer
3	Error code	1	Unsigned integer
4	CRC	2	Checksum

4.1.10.15 Pressure monitoring (External Filter)

The pressure monitoring is used when an external filter is fitted to the pump outlet suck as Andel’s FilterSepta unit.

Pressure monitoring is only configured from the Installer menu system. The options available for configuration are:

Pressure sensor type	Transducer (4-20mA)	Switch
Monitoring enable	Yes	Yes
Output type	Yes	Yes
Pressure sensor quantity	Yes	Yes
Pressure 1 threshold	Yes	
Pressure 2 threshold	Yes	
Pressure calibration 20mA	Yes	
Pressure calibration 4mA	Yes	
View pressure	Yes	

The output type of the pressure sensor used can either be a switched type, with a mechanical pressure threshold dial, or a 4-20mA current loop transducer type. The output type menu will allow the operator to select between these.

If a pressure transducer is selected for use, the menu pages for threshold, calibration, and option to view current pressure are applicable. Otherwise, with a switched pressure sensor, only the quantity of sensors can be adjusted to any effect. A switched pressure sensor is Boolean in output and requires no software configuration to work reliably.

The pressure sensor quantity page allows the user to set the number of pressure sensors connected to the BundGuard. This setting is irrespective of the sensor type selected.

Pressure calibration 4/20mA menus allow the user to set the minimum and maximum pressure values that are represented by current values of 4 and 20mA respectively. These values should be present or deducible from the datasheet for the sensor used. The BundGuard will calculate pressure using a proportional ratio of pressure/current set by the max min values provided.

Pressure thresholds are available for configuration when using transducer type sensors. The pressure threshold in PSI is selectable using the keypad. A filter over-pressure alarm will be raised should the pressure recorded be higher than the value set in this menu page.

4.1.10.16 Flow metering

Flow metering is only set if a flow meter has been fitted to the pump(s) outlet. The Flow metering can is configured from the installer menu system. The options available for configuration are:
-Meter enable
-View flow-rate
-Flow meter calibration 20mA
-Flow meter calibration 4mA
The meter enable configuration allows the installer to enable or disable the counting of liquid pumped.

4.1.10.17 GSM

The GSM menu is only available if the GSM module is installed. The menu pages available are:
-GSM enable (default: OFF)
-GSM forwarding number (default: blank)
-GSM info
The GSM forwarding number can be any number up to 15digits in length. This is the telephone number that all alarms will be forwarded to, when they occur. The number cannot have spaces or dashes within it, and so must be a consecutive string of numbers to be valid. This rule is enforced in the phone number entry page in the menu system.

The GSM info screen allows the user to scroll through details of the GSM and it's connectivity status. Within this page, the following information is available:
-SIM status
-Network status
-Operator name
These screens are refreshed every 0.5seconds and may take a few seconds or more to update any values to reflect any changes such as SIM insertion.

A GSM SMS message will always conform to a set layout. These are described below. All messages contain a timestamp when the message was generated, and the serial number of the BundGuard sending the message.

At power-up	**Pump over-current disable**	**All other**
01/01/70 00:00 Power was lost at 01/01/70 00:00 and resumed recently at 01/01/70 00:00 Serial#0000000000 Andel Ltd. BundGuard	01/01/70 00:00 Pump $PUMPNUM has been permanently disabled due to 3 consecutive over-current alarms Serial#0000000000 Andel Ltd. BundGuard	01/01/70 00:00 A $NAME alarm has occurred $DETAIL Serial#0000000000 Andel Ltd. BundGuard

The power-up message is a fixed length, and only the date, time, and serial number will vary representative of the alarm raised.

The Pump over-current disable is also a fixed-length. The “$PUMPNUM” variable is always either a “1” or “2” depending on the pump number that has been disabled.

All other alarms have two fields that vary in length. Possible values for each of these are shown below:

Alarm	$NAME	$DETAIL
High oil	high oil	
High water	high water	
Battery backup	mains fail	
Battery backup	mains resume	
Pump 1 over-current	pump1 over-current	$P1CURmA > $PTHRESHmA
Pump 2 over-current	pump2 over-current	$P2CURmA > $PTHRESHmA
Pump 1 disable	pump1 disable	
Pump 2 disable	pump2 disable	
Pressure 1 over threshold	filter 1 over-pressure	
Pressure 2 over threshold	filter 2 over-pressure	

The variables shown as $P1CUR, $P2CUR, and $PTHRESH are all decimal 5 digit unsigned decimal integer numbers representative of the instantaneous value of pump current for either pump ($P1CUR $P2CUR), or the current threshold that was exceeded ($PTHRESH). The “mA” suffix to these values is static and will not change.

4.1.11 Sim Inserted

The SIM card insertion status is shown in the first screen. The LCD will display whether the SIM is detected or not. This may take up to 10 seconds to update.

4.1.11.1 Network Status

The network status will show the connection status of the GSM module to the nearest cell tower.
Possible LCD messages for this are:
-Searching...
-Connected Home
-Denied Service
-Unknown status
-Roaming
Searching indicates the network module is attempting connection to a cell-tower. From starting the BundGuard to a Connection being made, can take up to 90 seconds. This value is refreshed every second when viewed.

Connected Home is the status in which the GSM module has successfully authenticated the SIM card onto the network and is able to send SMS messages and transmit and receive data.
Denied service is shown when the operator refuses to authenticate the SIM card or module onto their network. There are many reasons this may happen. A new un-authenticated SIM card is a likely culprit for this error message.

Unknown status is shown when an internal error has occurred within the GSM module, or a communication error has occurred on the network. Power-cycling the BundGuard and therefore re-attempting connection is recommended in this instance. In the case that this error occurs frequently, the operator should be informed of the issue.

Roaming indicates that access to your network is being provided by a 3rd party network. Connection to a home network is always attempted initially with the GSM module but roaming will occur when access to a network is provided automatically by partnering operators.

4.1.11.2 Operator name

This page of the menu indicates the operator name that the GSM module is connected to. It is provided for reference and can change if the GSM module were to be reset or lose connection. The operator can attempt to change this operator name by power-cycling the GSM module and thereby invocating another network initialisation sequence.

5.Technical Specification

Supply Voltage	230 Volts AC , 50 Hz
Power Consumption	
Standby	4.5W
Pump(s) Running	970W
Fuse Rating	
Control	FS1 0.5A 240Vac T 20mm
Pump 1	FS1 5A 240Vac T 20mm
Pump 2	FS1 5A 240Vac T 20mm
Mains Alert (Common alarm output)	FS1 5A 240Vac T 20mm
Weight	
Control	5.9Kg
Sensor & Pump	8.45Kg
Pump Flow Rate	140 litres / min @ 2-3m head
Dimensions (mm)	
Control	Height 410mm, Width 262mm, Depth 100mm
Sensor & Pump	Height 555mm, Width 180mm, Depth 230mm
Relay Ratings	
Mains Fail	220VDC @ 0.1Amps
System Fault	220VDC @ 0.1Amps
High Water	220VDC @ 0.1Amps
High Oil	220VDC @ 0.1Amps
Pump 2 Disable	220VDC @ 0.1Amps
Pump 1 Disable	220VDC @ 0.1Amps